EMBRYOLOGY.[1]

Ascaris Eggs and Temperature.—Dr. Luigi Sala[2] has applied the experimental method to the study of that classical object, the egg of *Ascaris megalocephala.* He exposed the eggs to a low temperature from 0° to 8° C. for an hour or more and then allowed them to develop under normal conditions of temperature, 25 to 30° C.

In such eggs most noteworthy changes are found in the processes of maturation and fertilization. The changes that cold brings forth concern the penetration of the sperm, the structure of the protoplasm of the egg, the formation of the egg membrane, the arrangement of the chromatic substance and of the achromatic substance, the formation of the polar bodies, the formation of the pronuclei and of the first cleavage nucleus.

These results of cold are illustrated by eighty-nine carefully executed figures and cannot readily be described in words, except in most general terms.

The effect upon the egg that may be mentioned under the first category, the penetration of the sperm, are in some cases the prevention of any entrance, but in most cases the entrance of several or even as many as 12 sperms.

That the protoplasm itself is changed is indicated by the fact that its staining reactions are different after the action of cold; while certain changes in optical appearance are also brought about by the same agent. The membrane about the egg is quite noticably different in the cooled eggs; it may be formed but slowly and imperfectly and when formed be changed so remarkably as to fuse with the membranes of other eggs, at least so the author interprets certain monstrous compounds of several eggs enclosed in a common membrane.

The spindels and their sharply marked groups of chromosomes appear in the cooled eggs in quite different guises. The chromatic material may remain in long threads with irregular thickness instead of assuming the characteristic two groups of four sharply circumscribed rods. The number of the chromatic elements is also changed in these abnormal eggs. The achromatic filaments of the spindles assume the most peculiar arrangements in double strands or sheafs, or in crossing

[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts, reviews and preliminary notes may be sent.

[2] Archiv. f. Mik. Anat., Feb. 1895.

X-shaped bands, or in multipolar spindles. In some, the appearances point to an active migration of the chromosomes inducing a stretching or dragging of the achromatic filaments.

Many remarkable perturbations appear in the formation of the polar bodies. Contrary to the rule, in Ascaris the first polar body may divide after its extrusion. The polar bodies may be exceedingly large, appearing like blastomeres, and contain more than their share of chromosomes. In one case the polar body had taken all of the eight chromosomes, leaving the egg with the sperm only.

The pronuclei are increased in number when the chromosomes that should enter the polar body remain behind in the egg, since they are modified into small nuclei.

In the first cleavage spindle the number of chromatic elements may be greater than normally results from the fusion of one male and one female pronucleus.

It is thus evident that very abnormal processes may take place in the eggs of Ascaris when exposed to low temperatures.

In attributing so much to the action of cold it must not be forgotten that many such abnormalities have been found in eggs that had never been exposed to such temperatures; it is difficult to say just what are the limits of the "normal" processes occurring under the average conditions.

Isolated Blastomeres in Ascidians.—Hans Driesch[3] has applied his experimental methods to the eggs of the Ascidian *Phallusia mammilata* and found here, as in the echinoderm, that an isolated blastomere may form a complete individual.

When the eggs are shaken in water for only twenty-five seconds some of the blastomeres are so changed that they die and remain as inert masses inside the egg membrane, while the other blastomeres continue to develop. In this way a complete larva may be formed within the egg membrane and adjacent to the dead blastomeres.

Such larvæ arise from one of the first two cleavage cells and are about half the normal size. Otherwise they are like the normal larvæ in being perfect and complete individuals, except that the sense organs and adhesive organs may be in part deficient, as is the case in larvæ reared from whole eggs when exposed to adverse circumstances.

The larvæ are not at all half individuals but whole individuals.

In the cleavage of these separate blastomeres there is never any arrangement of cells to represent half the normal state: the cells form a

[3] Archiv. Entwicklungsmechanik. March 8, 1895.

solid aggregate and do not appear as open or half blastulæ: nor is there any peculiarity about the gastrula stage except its small size. One of the first few cells forms an irregular solid mass by cleavage; one of the first four and also three of the first four cells when left alive also form a compact mass that does not represent a half, a quarter or a three-quarter indivldual, but a whole one.

There is thus no semi-morula.

The chorda dorsalis is like that of a complete egg larva and not a half structure.

The author thus adds the ascidian to the echinus, frog, fish, medusæ and siphonophores as cases in which an isolated blastomere has been found to produce, not a partial, but a complete individual.

It will be remembered that Roux, in the frog, and Chabry,[4] in the ascidian; as well as Chun, in the ctenophores, find cases where an isolated blastomere does not make a complete individual but only a half or a partial one.

The results obtained by Chabry are in Driesch's opinion the same as those he himself has just obtained, though otherwise interpreted by Chabry, Barfurth and Roux.

Considering the differences in the methods employed by Chabry and Driesch we can scarcely expect a very close agreement in the results. Chabry carefully thrust a fine needle into one cell and left the other little disturbed. Driesch violently shook both cells so that one did not continue to live and the other, its equal, must have been much changed in its relation to the first cell as well as internally altered by the mechanical jar.

Frogs' Eggs in Salt Solution.—Professor Oscar Hertwig[5] has applied the method first used by T. H. Morgan in the study of the frog's egg to a more detailed examination of the abnormal results following when the eggs are kept in water containing common salt.

He finds that when eggs of *Rana esculenta* or *R. fusca* are put into water containing from 1 per cent to 5 per cent sodium chloride they develop abnormally; in the stronger solution they are soon killed, in the weaker not for several days.

Larvæ that develop in a 6 per cent solution of salt are abnormal only in the remarkable failure of the blastopore to close, as already noted by Morgan, and in the failure of the medullary folds to close over in the middle region of the brain.

[4] American Naturalis., July, 1892.

[5] Archiv. f. Mik. Anat. 16 Feb., 1895.

The action of weak salt solution is thus apparent as a partial inhibition of the normal developmental processes.

A considerable part of the paper is taken up with a consideration of the differences of view between Weismann and Hertwig, and the application of these new facts to the epigenetic conception of development.

Stimuli in Embryology.—Curt Herbst[6] reviews all the various forms of movements that are called forth in the lower animals and in plants by the action of heat, light, chemical bodies, etc., and known commonly as thermotaxis, phototaxis, chemotaxis, etc., and then advances a plea for regarding such responses to stimuli as important factors in the development of the individual.

Physiological stimuli are thus to be regarded as important factors in the processes of animal ontogeny. Just as a plant or animal cell may move to or away from the source of light, heat or chemical action and just as a plant may bend toward or away from such agents or respond to gravity or to moisture, so, Herbst thinks, may cells and organs in the embryo move or change form in response to various stimuli.

He would thus explain many well known facts; the migration of nuclei to the surface of an insect egg may be the result of positive ærotaxis, that is, the response of the nuclei to stimuli coming from the more abundant oxygen near the surface of the egg. The movements of vitellophags likewise may be the results of definite stimuli.

In later stages the remarkable collecting of mesenchyma cells to invest nerve processes, etc., that is, the formation of the sheath of Swan and the neurilemma as well as the coats of blood vessels may again be due to migrations under the directive influence of stimuli. Even the outgrowth of nerve fibres to the end organs (generally regarded as actually taking place) may not be along the lines of least resistance but controlled by directive stimuli.

All this, it will be observed, is an outgrowth of the observations upon lithium salts and echinoderm larvæ noticed in this journal for December, 1893.

[6] Biologische Centralblatt, Nov., 1894.